Netherlands Food and Consumer
Product Safety Authority
Ministry of Agriculture,
Nature and Food Quality

Biobased Food Contact Materials

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RIVM research on substitution of single use plastics

- https://rivm.openrepository.com/handle/10029/626676
- Plant-based materials as alternative for SUP:
  - Paper and paperboard, wood
  - More exotic materials (bamboo, palm leaves, bagasse)
- High prioritised chemical constituents in alternative materials:
  - Formaldehyde (paper, wood, bamboo, bagasse)
  - BPA (paper, wood)
  - DIBP, DEHP, DBP (paper)
  - Lead (paper)

Biobased materials

- Plant-based raw materials
- From renewable sources
- Bioplastics: from plant-based monomers (not necessarily biodegradable)

Biobased materials: risk government

- In 2020 the risk governance was examined in the lifecycle of 3 innovative bio-based plastic FCM
- Interviews, literature and chemical analysis
- Insufficient communication in the chain
- Some measures are at place, but not all risks are covered

https://doi.org/10.1080/13669877.2021.1894473

Dutch FCM legislation

- (Bio)plastics: Chapter I (Regulation 10/2011)
- Paper and Paperboard: Chapter II
- Wood: Chapter IX
- Other plant-based materials: Chapter VII (textiles)

Market investigation biobased FCM

- Sampling in retail in 2022
- Aim: to investigate which substances are present that may present a health risk
- Investigate if legal framework is sufficient
- Analysis (based on literature)
  - Plant protection products
  - PFAS
  - Certain elements
  - General GC-MS screening

Sampling (n=28)

- Paper and paperboard (n=7)
- Wood (n=4)
- Bamboo (n=4)
- Bagasse (n=3)
- Palm leaves (n=2)
- Banana leaves (n=1)
- Cocos shell (n=1)
- Reed (n=1)
- Wheat (n=2)
- Bioplastic (polylactic acid) (n=3)

wheat straw

sugar cane bowl

bagasse cup

coconut boat

Results: plant protection products (WFSR)

- 10 of the 28 samples contained active substances
- Not detected in bioplastics, coconut shell and palm leaves
- Most of the active substances are not authorised in the EU
- All 3 straws contained plant protection products:
  Additional direct oral exposure

Active substance	Materials detected	Maximum (mg/kg)	Authorised in EU	ARfD (mg/kg bw)
Carbendazim	bagasse, bamboo, wheat	>20 mg/kg	no	0.02
Chlorpyrifos	bamboo, banana, wood	0.038 mg/kg	no	Not available
Cypermethrin	banana, wheat	1 mg/kg	yes	0.005
Pyraclostrobin	reed	0.026 mg/kg	yes	0.03
Acetamiprid	bagasse	0.018 mg/kg	yes	0.025
Tricyclazole	bamboo	0.020 mg/kg	no	0.05
Tebufenpyrad	paper	0.016 mg/kg	yes	0.02
Fenvalerate	paper	0.045 mg/kg	yes	0.0175
Flutriafol	reed	0.013 mg/kg	no	0.05
Imidacloprid	reed	0.046 mg/kg	no	0.08
Permethrin	reed	0.066 mg/kg	no	Not available
Propiconazole	reed	0.057 mg/kg	no	0.1
Tetramethrin	reed	0.045 mg/kg	no	Not available

PFAS results

- EFSA-4, perfluorocarboxylic acids, perfluorosulphonates, fluorotelomer alcohols, sulphonamides, fluorotelomer sulphonates, mono- and diPAPs, perfluoroalkylphosphinates
- In many samples not detected or in small amounts (4-18 µg/kg)
- In 3 bamboo articles 6:2 FTOH was detected in significant amounts: 0.5 to 1.7 mg/kg
- PFAS not authorized for FCM
- At what level is PFAS considered NIAS and when IAS?

Certain elements

- Measured by total destruction
- High contents of aluminium, manganese, iron, zinc and barium (>100 mg/kg)
- Arsenic, lead and mercury were found in low contents (< 1 mg/kg)
- Only for few elements an SML is set
- SML’s not consistent for the 4 material categories (in NL)

Certain elements

Element	present (%)	maximum (mg/kg)	SML plastic (mg/kg food)	SML paper (mg/kg food)	SML textile (mg/kg food)	SML wood (mg/kg food)
Lithium	39	1,8	0.6		0.6	
Boron	79	46		1	1	
Aluminium	100	2600	1		1	
Vanadium	36	1,6				
Chromium	86	2,2	n.d.			0.1
Manganese	96	770	0.6		3	
Iron	100	710	48			
Cobalt	29	2,2	0.05			
Nickel	43	1,2	0.02			
Copper	93	80	5			5
Zinc	100	190	5		5	

Certain elements - 2

Element	present (%)	maximum (mg/kg)	SML plastic (mg/kg food)	SML paper (mg/kg food)	SML textile (mg/kg food)	SML wood (mg/kg food)
Arsenicum	7	0,5	n.d.	0.01		0.01
Selenium	25	0,7				
Rubidium	50	20				
Strontium	93	54				
Zirkonium	32	9,6				
Molybdenum	18	1,8				
Rubidium	14	0,8				
Barium	96	110	1	1		
Cerium	21	0,9				
Mercury	14	0,5	n.d.	0.005		
Lead	25	1,1	n.d.			

GC-MS screening

- Hexane and ethanol as extraction solvents
- A lot of extractables:
  - Plant sterols
  - Hydrocarbons
  - Plasticisers
  - Antioxidants
- Not authorized for plant-based FCM
- What is NIAS and what is IAS and how to distinguish?

Plasticisers (GC-MS screening)

- Bioplastics (PLA):
  - Tributylcitrate
  - Triethylphosphate

- Paper and paperboard, bamboo, wood, bagasse:
  - Phthalates: DBP, DIBP, DEHP, DEP
  - Tributylcitrate and tributylacetylcitrate
  - DEHA

GC-MS screening

- Plant sterols:
  - Gamma-sterol
  - Stigmastanol
  - Campesterol
  - Sitosterol
- Antioxidants:
  - 2,4-di-tert-butylphenol
  - 2,6-di-tert-butyl-4-methylphenol
  - Phenol

Plastic coating

- 6 out of the 7 paper materials were coated with either polyethylene or polypropylene
- Not in compliance with SUP directive
- Sometimes bioplastics are used as coating, however bioplastics are not exempted from SUP directive

Labelling

- Eco friendly
- Think green
- Biodegradable
- Compostable
- Renewable material
- Natural material
- Wood from well managed-forests

Article 3 of the Framework Regulation 1935/2004:

The labelling, advertising and presentation of a material or article shall not mislead the consumers

Greenwashing?

Conclusions

- Biobased materials may contain substances that give rise to a health concern:
  - plant protection products, PFAS, certain elements and plasticisers
- No migration data, therefore no quantitative risk assessment
- Bioplastics are covered by Regulation 10/2011
- Dutch legislation for other plant-based materials, however no requirements for end product with regard to:
  - PFAS, plant protection products
  - No consistent SML's for certain elements

Paper straws

- 22 paper straws were analysed for PFAS
- PFOA, GenX, PFCA’s were detected
- All straws contained PFAS up to 20 µg/kg (22 ng/straw)
- NIAS or intentionally added?

- Certain elements and GC-MS screening is planned for Q3 2023

RIVM research project on reuse of FCM

- Reusable FCM:
  - Straws
  - Take-away food and drinks
  - Cups and others for festivals
  - Plastic drink bottles
- Inventarisation:
  - Materials for reusable FCM
  - Chemical, physical and microbiological risks
- Report expected in Q1 of 2024

Thank you for your attention!

- Questions?